

Process Specification for Specialty Anodizing of Aluminum Alloys to Control Optical Properties

Engineering Directorate

Structural Engineering Division

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Process Specification for Specialty Anodizing of Aluminum Alloys to Control Optical Properties

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REVISIONS		
VERSION	CHANGES	DATE
Baseline	Original version	1/30/98
A	Changed EM references to ES	6/28/02

1.0 SCOPE

This process specification establishes requirements for anodizing of aluminum alloys for JSC flight hardware, when controlled optical properties are required.

2.0 APPLICABILITY

This specification includes two types and two classes of clear, sulfuric acid anodic coatings. It is to be used only when tightly controlled optical properties are required, and shall not be used without prior approval of the appropriate JSC/ES4 materials engineering personnel. If controlled optical properties are not required, a standard anodize should be used per NASA/JSC PRC-5006, *Process Specification for the Anodizing of Aluminum Alloys*.

3.0 USAGE

This specification shall be called out on the engineering drawing by using a drawing note that identifies the process specification, type of anodic coating, and the class required. A sample drawing note is:

SPECIALTY ANODIZE PER NASA/JSC PRC-5008, TYPE x, CLASS y

The following types and classes of anodic coating are applicable to this procedure:

Type II	Sealed sulfuric acid anodic coating, produced from sulfuric acid bath, thickness 0.0004 inches or greater
Type III	Unsealed hard anodic coating, thickness 0.002 +/- 0.0005 inch
Class 1	Optical properties measured on the production hardware
Class 2	Optical properties measured on coupons electrically connected to the production hardware during the anodizing process

3.1 WORK INSTRUCTIONS

Detailed work instructions shall be generated for implementing this process specification and shall be consistent with the requirements set forth in Rev. K of McDonnell Douglas Standard STP0554, *Sulfuric Acid Anodic Coatings with Controlled Optical Properties for Aluminum and Aluminum Alloys*, as-modified by Section 3.2 below.

3.2 EXCEPTIONS TO MCDONNELL DOUGLAS STANDARD STP0554K

Verify that this is the correct version before use.

The following exceptions to STP0554K shall apply to JSC flight hardware:

- 1) SEC 1.2 - Classification: Class 3 anodizing is not permitted by this PRC. If optical properties do not need to be controlled and measured, hardware should be anodized per NASA/JSC PRC-5006, *Process Specification for the Anodizing of Aluminum Alloys*. Any further mentioning of Class 3 anodizing in STP0554K should be disregarded.
- 2) SEC 3.5.1 - Preproduction test article configuration: The preproduction test article may be either of the two forms listed, or of a different configuration, provided that the alternate configuration has been approved by the appropriate JSC/ES4 materials engineering personnel. The coupon configuration requirements given for 7075-T7351 plate shall apply to all 7XXX series aluminum plate material.
- 3) SEC 3.5.4.4 - Production test coupons: Class 1 production coupons are required only if the surface area of the production parts or hardware is insufficient to support the required number of solar absorptance and infrared emittance measurements. Class 2 lots shall continue to require six production coupons. The coupon configuration requirements given for 7075-T7351 plate shall apply to all 7XXX series plate material.
- 4) SEC 3.11 - Rework: Upon NASA/JSC approval, the anodic coating of the production hardware may be reworked once by stripping and re-anodizing, using the stripping agent listed in MIL-A-8625F, section 4.5.2.1b. The stripping time and temperature shall be provided by JSC/ES4 materials engineering personnel on a case-by-case basis. Stripping with any other solution will alter the optical properties of the material and is expressly prohibited. In the event that rework is approved, the preproduction articles shall be stripped and re-anodized using the identical process as the production hardware. Any existing production coupons shall be processed identically as well.

4.0 REFERENCES

All documents listed are assumed to be the current revision unless a specific revision is listed.

JPG 8500.4	<i>Engineering Drawing System Manual</i>
MIL-A-8625F	<i>Military Specification, Anodic Coatings for Aluminum and Aluminum Alloys</i>

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PRC-5006	NASA/JSC PRC, <i>Process Specification for the Anodizing of Aluminum Alloys</i>
STP0554K	McDonnell Douglas Standard, <i>Sulfuric Acid Anodic Coatings With Controlled Optical Properties for Aluminum and Aluminum Alloys</i>

5.0 MATERIAL REQUIREMENTS

5.1 PREPRODUCTION TEST ARTICLES

The hardware developer (project) must supply preproduction test articles along with the flight hardware, unless otherwise negotiated with the appropriate JSC/ES4 materials engineering personnel. The form and function of the preproduction articles are discussed in McDonnell Douglas Standard STP0554K, SEC 3.5-3.5.1, and is modified by exception 2 in Section 3.2 above. If coupons are used as the preproduction test article (option (2) in SEC 3.5.1), they shall be made from the same alloy, temper, and form as the production hardware, preferably from the same lot of material used for the production hardware. Coupon drawings may be obtained from JSC/ES4 materials engineering personnel.

5.2 PRODUCTION TEST COUPONS

Production test coupons are required for Class 2 hardware and for some Class 1 hardware (those which cannot support the required number of solar absorptance and infrared emittance measurements). The form and number of coupons required is specified in STP0554K, SEC 3.5.4.4, as-modified by exception 3) in Section 3.2 above. The coupons shall be made from the same alloy, temper, and form as the production hardware, preferably from the same lot of material used for the production hardware. These test coupons are the responsibility of the hardware developer and must be presented with the hardware to be anodized, unless otherwise negotiated with JSC/ES4 materials engineering personnel. Coupon drawings may be obtained from JSC/ES4 materials engineering personnel.

6.0 PROCESS REQUIREMENTS

The vendor shall use the current version of this PRC and the McDonnell Douglas Standard STP0554K when generating detailed work instructions and in the processing of hardware. Should a conflict exist between these two documents, this PRC shall take precedence over STP0554K when processing JSC flight hardware.

With the exceptions listed in Section 3.2 above, all requirements for this anodizing process are listed in McDonnell Douglas Standard STP0554 (Rev. K), *Sulfuric Acid Anodic Coatings for Aluminum With Controlled Optical Properties for Aluminum and Aluminum Alloys*. Process requirements for anodizing temperature are listed in STP0554K SEC 3.5.3.1 for the preproduction test article and SEC 3.5.4.1 for the production hardware and/or coupons. In addition, requirements for anodizing amperage and voltage are given in SEC 3.5.3.2 for the preproduction test article and SEC 3.5.4.2 for the production hardware and/or coupons.

Only vendors that have been qualified by McDonnell Douglas according to the qualification tests specified in STP0554K and that are listed in SEC 6.8 of STP0554K shall be contracted to perform this process.

7.0 PROCESS VERIFICATION

Refer to McDonnell Douglas Standard STP0554K for process verification requirements. Optical properties must be verified for both the preproduction test article (SEC 3.6.4) and the production hardware or coupons (SEC 3.6.5). In addition, verification requirements are listed for coating thickness (SEC 3.6.1), corrosion resistance of Type II anodic coatings (SEC 3.6.2), and abrasion resistance of Type III anodic coatings (SEC 3.6.3).

8.0 TRAINING AND CERTIFICATION OF PERSONNEL

All anodizing of aluminum alloys shall be conducted by trained personnel. Training of personnel shall be the responsibility of the vendor. Qualification of vendors to McDonnell Douglas Standard STP0554 shall be the responsibility of the McDonnell Douglas Corporation.

9.0 DEFINITIONS

Anodizing Process	Procedure by which aluminum and aluminum alloys are treated electrolytically in a bath containing sulfuric acid to produce a uniform anodic coating on the metallic surface.
Infrared Emittance	Fraction of energy that is re-radiated in the infrared spectrum by a surface when compared relative to a blackbody (i.e. a perfect emitting surface).
Optical Properties	Values obtained from the measurement of solar absorptance and infrared emittance.

Sealing	Process by which aluminum is immersed in boiling, deionized water for 15-30 minutes; partially converts the alumina of the anodic coating to aluminum monohydroxide. For this PRC, only Type II anodic coatings are sealed.
Solar Absorptance	Fraction of incident energy in the visible spectrum that is absorbed by a surface.